PB91-182626

# Pesticide Fact Sheet No. 75.1: Captan

(U.S.) Environmental Protection Agency, Washington, DC

10 Feb 89

U.S. Department of Commerce
National Technical Information Service
NTIS

50272-101

| REPORT DOCUMENTATION PAGE | 1. REPORT NO. | 2. | 3. PB91-182626 |
|---|---|---|---|
| 4. Title and Subtitle: EPA Pesticide Fact Sheets - Captan No. 75.1 | | | 5. Report Date: February 10, 1989 |
| 7. Author(s): EPA, Office of Pesticide Programs, Special Review & Rereg. Div. | | | 6. |
| 9. Performing Organization Name and Address: U.S. Environmental Protection Agency, Office of Pesticide Programs, Special Review & Reregistration Division (H7508C), 401 M Street, S.W., Washington, D.C. 20460 | | | 8. Performing Organization Rept. No. 540/FS-91-132 |
| | | | 10. Project/Task/Work Unit No. |
| | | | 11. Contract(C) or Grant(G) No. (C) (G) |
| 12. Sponsoring Organization Name and Address: same as #9 | | | 13. Type of Report & Period Covered |
| | | | 14. |

15. Supplementary Notes

16. Abstract (Limit: 200 words)

This document contains up-to-date chemical information, including a summary of the Agency's regulatory position and rationale, on a specific pesticide or group of pesticides. A Fact Sheet is issued after one of the following actions has occurred.

1. Issuance or reinssuance of a registration standard,
2. Issuance of each special review document,
3. Registration of a significantly changed use pattern,
4. Registration of a new chemical, or
5. An immediate need for information to resolve controversial issues relating to a specific chemical or use pattern.

17. Document Analysis a. Descriptors

Pesticides, regulations, Chemical Information Fact Sheet, Use Patterns, science findings.

b. Identifiers/Open-Ended Terms

c. COSATI Field/Group

REPRODUCED BY
U.S. DEPARTMENT OF COMMERCE
NATIONAL TECHNICAL
INFORMATION SERVICE
SPRINGFIELD, VA 22161

| 18. Availability Statement | 19. Security Class (This Report) | 21. No. of Pages |
|---|---|---|
| Publicly Available | unclassified | |
| | 20. Security Class (This Page) unclassified | 22. Price |

United States
Environmental Protection
Agency

Office of Pesticides and Toxic Substances
Office of Pesticide Programs (TS-766C)
Washington, DC 20460

540/FS-91-132

EPA

# Pesticide Fact Sheet

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|---|---|
| Name of Chemical: | CAPTAN, N-trichloromethylthio-4-cyclohexene-1,2-dicarboximide |
| Reason for Issuance: | Conclusion of Special Review (Final Determination) |
| Date Issued: | February 10, 1989 |
| Fact Sheet Number: | 75./ |

## 1. Description of Chemical

Generic Name: N-trichloromethylthio-4-cyclohexene-1, 2-dicarboximide

Common Name: Captan

Trade Names: Merpan, Orthocide, SR-406, and Vancide 89

EPA Shaughnessy Code: 081301
Chemical Abstract Service (CAS) Number: 133-06-2
Year of Initial Registration: 1951
Pesticide Type: Fungicide
Producers: Chevron Chemical Company
ICI Americas Inc.
Makhteshim-Agan (Americia) Inc.

## 2. Use Patterns and Formulations

Application Sites: Captan (N-trichloromethylthio-4-cyclohexene-1,2-dicarboximide) is a fungicide federally registered for application in the following general use patterns: terrestrial food crops, terrestrial nonfood crops, greenhouse, indoor, domestic outdoor and forestry. The terrestrial food crop uses include application to almonds, apples, apricots, cantaloupes, cherries, cucumbers, grapes, necarines, peaches, pears, plums (fresh prunes), strawberries, and tomatoes. This general use category also includes seed treatment for most commercial plant seeds. The terrestrial nonfood crops uses includes foliar applications to azaleas, begonies (tuberous), camellias, carnations, chrysanthemums, dichondra, grasses (ornamental in nonpastured areas only), grasses (lawn seed-beds), hollyhocks, lilacs, snapdragon, spireas, roses, and stocks; applications to soil and to greenhouse benches used in the culture of flowers, roses, shrubs and trees; application as a dip to gladiolus corms; and application to soil used for the culture of greenhouse ornamentals and vegetables.

Indoor uses include: postharvest application to fruits,

application to surfaces of the following articles: awnings, blankets, clothing, draperies, leather goods, luggage, mattresses, rugs, and shoes; to the surfaces of boats, closets, floors, storage rooms, walls, upholstery packing boxes used for storage of fruits and vegetables, and wookshops; and in the manufacture of lacquers, paints (oil based), paper, cardboard, paste (wallpaper flour), plasticizers, polyethylene, rubber stabilizer, textiles, vinyl, and vinyl resins.

Types of Formulations: Dusts, wettable powders, aqueous suspensions and granules.

Types and Methods of Application: Dusting, spraying, misting, dipping, mixing, and low pressure aerosols.

Application Rates: See use patterns in USDA Compilations of Registered Uses of Fungicides and Nematicides, Part I, Pages C-10-00-01 to C-10-00.21. The currently registered food and feed use patterns will be reflected in the next revisions of that document.

Usual Carriers: Clay, talc, silica, and water.

3. Scientific Findings

Chemical Characteristics:

| | |
|---|---|
| Physical State: | Pure is white crystals, technical is white to buff colored amorphous powder. |
| Color: | White to buff |
| Odor: | Pure is oderless, the technical is pungent. |
| Melting Point: | 158-164 °C |
| Vapor Pressure: | Less than $10^{-6}$ mm Hg at 25 °C. |
| Solubility: | Practically insoluble in water, soluble in acetone, ethanol, kerosene, xylene, chloroform and benzene. |
| Stability: | Regarded as stable. Decomposes slowly at the melting point. In solution captan decomposes rapidly depending on the pH and temperature, being slower at pH 4 and rapid at pH above 10. |

Toxicity Characteristics:

Acute Oral $LD_{50}$ - Rat - males 9 gm/kg, Category IV
- females No Data, Category IV

Acute Inhalation $LD_{50}$ - Rat - males 5.8 mg/L, Category III
- females > 8.9 mg/L, Category III

Eye Irritation - Rabbit - corneal opacity, iris and conjunctive irritation present through day 21, Category I.

Dermal Sensitization - Moderate sensitizer.

Subchronic Rodent - Filled with 2 year chronic feeding study in rats.

Teratogenicity - Rabbit - not teratogenic at 6, 12, 25, or 60 mg/kg/day. Maternal toxicity observed as weight loss at high dosage.

- Hamster - dosed at 50, 200, and 400 mg/kg/day. Severe weight loss at 400 mg/kg/day. Incidence of skeletal abnormalities; i.e., fused ribs, was increased at high dosage. These lesions were considered to be within normal background incidence.

Reproduction and Fertility Effects (feeding)

a. Three Generation Reproduction Study - Rats: Rats were fed 25, 100, 250, and 500 mg/kg/day for three generations. Body weight reductions occurred at 100, 250, and 500 mg/kg/day and a reduction of food consumption occurred at 100, 250, and 500 mg/kg in $F_1$ males and $F_2$ females. Pup litter weights were decreased in all dosage groups.

b. One Generation Reproduction Study - Rats: Rats were fed a diet of 6, 12.5, and 25 mg/kg/day. No treatment related effects due to captan were seen. The NOEL for these studies (a and b) when combined, is 12.5 mg/kg/day.)

Mutagenicity

i. Gene Mutation

- In vivo somatic mutation assay with mice - no mutations were observed.

- Captan was mutagenic to various strains of S. typhimurium in saline. Decreased mutagenicity was observed when captan was incubated with blood

or urine. Captan was not mutagenic in the host mediated assay in mice or rats with S. typhimurium his G46 or TA 1950. Negative findings were also obtained in vitro with blood or urine of captan-treated mice or rats.

- Captan was mutagenic for point mutations in E. coli and S. typhimurium. However, it did not produce heritable chromosome aberrations in vivo (this was the conclusion of a working group chaired by W.M. Generoso.)

- Captan was not mutagenic for the dominant lethal test using C3H male and SLR-ICR female mice. No significant increases in chromosomal aberrations were observed in human fibroblosts in vitro or in bone marrow cells of Wistar rats in vivo.

ii. Chromosomal Aberrations

- Chinese hamster V79 cells were treated with captan technical at concentrations up to 6.0 x $10^{-5}$ M. Chromosomal aberrations were observed at 4.5 x $10^{-5}$. Increased frequency of sister chromatid exchanges were observed at 1.5 x $10^{-5}$ M and above.

iii. Unscheduled DNA Synthesis (UDS)

- Wl-38 cells were incubated with captan technical and tritiated thymidine for 3 hr without or 1 hr with S-9 activation. The DNA was extracted and the incorporated labeled thymidine counted. Captan did not induce UDS in Wl-38 cells

iv. Based on these data, EPA has concluded that captan poses little or no risk of producing mutagenic effects in humans.

Chronic Toxicity (feeding)

Rat:

In a rat feeding study at 0, 25, 100, and 250 mg/kg/day treatment-related neoplasms (renal tubular adenomas and carcinomas) in males were observed at 100 and 250 mg/kg/day. The LEL was 100 mg/kg/day based on hepatocellular hypertrophy, increased kidney weight (male and female) and decreased body weight (male and female). The NOEL was 25 mg/kg/day. This study partially satisfies the chronic testing requirement for registration.

Oncogenicity

a. Rat

See above, chronic toxicity in the rat.

b. Mouse (high dose study)

In a CD-1 mouse study technical captan at dietary concentrations of 6,000, 10,000, and 16,000 ppm induced both benign and malignant duodenal tumors in both males and females.

c. Mouse (low dose study)

In a second CD-1 mouse study there was an increased incidence of focal hyperplasia, adenoma/polyp(s) and primary carcinomas in the gastrointestinal tract of both male and female mice at the highest level tested (6,000 ppm) and a possible increase at the lower dosage levels.

d. Based on these data showing statistically and biologically significant oncogenic responses in both sexes of mice and in male rats, on the structural activity relationship between captan and the oncogens folpet and captafol, and the unusual tumor type (gastrointestinal tumors), EPA has concluded that captan is a class $B_2$ or probable human carcinogen. The potency, or $Q_1$*factor, is $3.6 \times 10^{-3}$.

Physiological and Biochemical Behavioral Characteristics:

Foliar Absorption: Captan and/or its metabolites and degrates is (are) absorbed by roots and shoot of plants.

Translocation: Captan and/or its metabolites and degrates is (are) translocated in plant tissue. Captan and/or its metabolites and degradates is (are) absorbed and translocated within plants as a result of seed treatment, soil treatment and foliar application.

Metabolism and Persistence in Plants and Animals:

The metabolism and accumulation of captan in plants are not understood. The metabolism of captan is understood for ruminants but not for avian species.

Environmental Characteristics: Data gap

Ecological Characteristics:

Hazards to Fish and Wildlife

Bluegill sunfish 96 hr $LC_{50}$ = 0.047 - 0.111 ppm
Rainbow trout 96 hr $LC_{50}$ = 0.66 - 0.080 ppm
Characterized as "very highly toxic" to both cold water and warm water fish. Inadequate data for fish accumulation.

Daphnia magna: 48 hr $LC_{50}$ = 7.06 - 9.96 mg/L
Moderately toxic to aquatic invertebrates.

Avian Toxicity: $LC_{50}$ = quail > 2400 ppm

Avian Reproduction: Available data indicate that captan does not impair avian reproduction.

Potential problems related to endangered species. The Agency has made a preliminary finding that the use of captan as a fungicide in rice, cranberries, and citrus may affect the status of endangered birds, fish, and insect species. An endangered bat may be affected by the use of captan on taro in Hawaii. The Agency will seek the opinion of the U.S. Fish and Wildlife Service in these matters, to better determine what, if any, actions are necessary to protect these species.

Efficacy Review Results:

Captan product registrations with EPA have been supported with efficacy data. Tolerant strains of target plant pathogens have not been reported.

Tolerance Assessments:

a. List of Crops and Tolerances:

The following table lists the present status for tolerances in parts per million (ppm) for residues of captan:

| Raw Agricultural Commodity | Part Per Million in Captan Residues | | | |
|---|---|---|---|---|
| | U.S. | Canada | Mexico | Codex |
| ALMOND, HULLS | 100.0I* | - | - | - |
| ALMONDS | 2.0I | - | - | - |
| APPLES | 25.0** | 5.0 | 25.0 | 25.0 |
| APRICOTS | 50.0 | 5.0 | - | 20.0 |
| AVOCADOS | 25.0 | - | - | - |
| BEANS, DRY | 25.0I | - | 25.0 | - |
| BEANS, SUCCULENT | 25.0I | - | 25.0 | 10.0 |
| BEETS, GREENS | 100.0 | - | - | - |
| BEETS, ROOTS | 2.0 | - | - | - |
| BLASCKBERRIES | 24.0 | - | - | - |
| BLUEBERRIES (HUCKLEBERRIES) | 25.0 | 5.0 | - | 20.0 |
| BROCCOLI | 2.0 | - | 2.0 | - |
| BRUSSELS SPROUTS | 2.0 | - | - | - |
| CABBAGE | 2.0 | - | 2.0 | - |
| CANTALOUPS | 25.0 | - | 25.0 | - |
| CARROTS | 2.0 | - | 2.0 | - |
| CATTLE, FAT | 0.05 | - | - | - |
| CATTLE, MBYP | 0.05 | - | - | - |
| CATTLE, MEAT | 0.05 | - | - | - |
| CAULIFLOWER | 2.0 | - | 2.0 | - |
| CELERY | 50.0 | - | 50.0 | - |
| CHERRIES | 100.0 | 5.0 | - | 50.0 |
| COLLARDS | 2.0 | - | - | - |
| CORN, SWEET (K+CWHR) | 2.0 | - | 2.0 | - |
| COTTON, SEED | 2.0 | - | 2.0 | - |
| CRABAPPLES | 25.0 | 5.0 | 25.0 | 25.0 |
| CRANBERRIES | 25.0 | 5.0 | - | 10.0 |
| CUCUMBERS | 25.0 | - | 25.0 | 10.0 |
| DEWBERRIES | 25.0 | - | - | - |
| EGGPLANT | 25.0 | - | - | - |
| GARLIC | 25.0 | - | 25.0 | - |
| GRAPEFRUIT | 25.0I | - | - | 15.0 |
| GRAPES | 50.0 | 5.0 | - | - |

*I Interim tolerance pending evaluation of captan under Rebuttable Presumption Against Registration (RPAR) review on transfer of residues to meat, milk, and eggs from feeding the raw agricultural commodity or their byproducts.

** Established tolerance under regulation, Section 180.103, 40 CFR.

Continued

| Raw Agricultural Commodity | Part Per Million in Captan Residues | | | |
|---|---|---|---|---|
| | U.S. | Canada | Mexico | Codex |
| HOGS, FAT | 0.05 | - | - | - |
| HOGS, MBYP | 0.05 | - | - | - |
| HOGS, MEAT | 0.05 | - | - | - |
| HONEYDEW MELONS | 25.0 | - | 25.0 | - |
| KALE | 2.0 | - | - | - |
| LEEKS | 50.0 | - | - | - |
| LEMONS | 25.0I | - | - | 15.0 |
| LETTUCE | 100.0 | - | 100.0 | 10.0 |
| LIMES | 25.0I | - | - | 15.0 |
| MANGOES | 50.0 | - | 50.0 | - |
| MUSKMELONS | 25.0 | - | 25.0 | - |
| MUSTARD, GREENS | 2.0 | - | - | - |
| NECTARINES | 50.0 | - | - | - |
| ONIONS, DRY BULB | 25.0 | - | 25.0 | - |
| ONIONS, GREEN | 50.0 | - | 50.0 | - |
| ORANGES | 25.0I | - | - | 15.0 |
| PEACHES | 50.0 | 5.0 | 40.0 | 15.0 |
| PEARS | 25.0 | 5.0 | 25.0 | 25.0 |
| PEAS, DRY | 2.0 | - | 2.0 | - |
| PEAS, SUCCULENT | 2.0 | - | 2.0 | - |
| PEPPERS | 25.0 | - | - | 10.0 |
| PIMENTOS | 25.0 | - | - | 10.0 |
| PINEAPPLES | 25.0I | - | 25.0 | - |
| PLUMS (FRESH PRUNES) | 100 | 5.0 | - | 10.0 |
| POTATOES | 25.0I | - | 2.0 | 15.0 |
| PUMPKINS | 25.0 | - | - | - |
| QUINCES | 25.0 | - | - | - |
| RASPBERRIES | 25.0 | 5.0 | - | 10.0 |
| RHUBARB | 25.0 | - | - | 15.0 |
| RUTABAGAS, ROOTS | 2.0 | - | - | - |
| SHALLOTS | 50.0 | - | - | - |
| SOYBEANS, DRY | 2.0 | - | 2.0 | - |
| SOYBEANS, SUCCULENT | 2.0 | - | 2.0 | - |
| SPINACH | 100.0 | - | 100.0 | 20.0 |
| SQUASH, SUMMER | 25.0 | - | - | - |
| SQUASH, WINTER | 25.0 | - | - | - |
| STRAWBERRIES | 25.0 | 5.0 | 25.0 | 20.0 |
| TANGERINES | 25.0I | - | - | 15.0 |
| TARO (CORN) | 0.25 | - | - | - |
| TOMATOES | 25.0 | 5.0 | - | 15.0 |
| TURNIPS, GREENS | 2.0 | - | - | - |
| TURNIPS, ROOTS | 2.0 | - | - | - |
| WATERMELONS | 25.0 | - | 25.0 | - |

A feed additive regulation (§561.65, Title 21, Code of Federal Regulations; Parts 500 to 599) permits residues of captan at 100.0 ppm remaining on corn seed from its intended use as a seed protectant after detreatment. Detreated corn seed can be used only as a feed for cattle and hogs up to 14 days prior to slaughter.

A food additive regulation (§193.40, Title 21, Code of Federal Regulations Parts 170 to 199) permits 50.0 ppm residues of captan in or on washed raisins when present as a result of fungicidal treatment by preharvest application to grapes and postharvest application during the drying process.

No tolerances have been established for captan residues in or on any crop commodity for which captan is registered solely for seed or plant propagule application, because heretofore seed or plant propagule applications were considered as non-food uses. Seed use sites are listed under Use Patterns and Formulations.

b. Total dietary exposure to residues of captan is 0.001606 mg/kg/day using EPA's Tolerance Assessment System. Using this exposure estimate, the upper-bound on lifetime oncogenic risk is $10^{-6}$ to $10^{-5}$ for the overall U.S. population.

4. Regulatory Position and Rationale

As stated above, the upper-bound lifetime oncogenic risk from dietary exposure to captan from all registered uses is now estimated to be $10^{-6}$ to $10^{-5}$. This is the sum of the risks from more than 60 food uses of captan. There is no individual crop for which the risk is higher than $10^{-6}$. EPA has conducted a risk-benefit assessment of each of the uses. Many food uses are registered but no longer actually being used. When food uses with minimal or no benefits are dropped from the risk calculation, cumulative dietary risk then becomes $10^{-6}$.

The following food uses are being retained in this Final Determination: almonds, apples (pre- and post-harvest), apricots, blackberries, blueberries, celery (plant-bed), cherries (pre- and post-harvest), dewberries, eggplant (plant-bed), grapes, green onions, lettuce, mangoes, nectarines, peaches, pears (post-harvest only), peppers (plant-bed), pimientos (plant-bed), plums/prunes, raspberries, spinach (plant-bed), strawberries, taro, tomatoes (plant-bed), and all seed treatments.

The following food uses are being cancelled as a result of this decision: avocados, beans, beets, broccoli, Brussels sprouts, bulb onions, cabbage, carrots, cantaloupe, cauliflower, celery (foliar), collards, cotton, crabapple, cranberries, cucumber, eggplant (foliar), grapefruit, honeydew, kale, leeks, lemons, limes, muskmelon, mustard greens, oranges,

pears (pre-harvest), peas, pineapple, potatoes, pumpkin, quince, rhubarb, rutabaga, shallots, soybeans, squash, sweet corn, tangerines/tangelos, tomatoes (foliar), turnips, and watermelon.

Of the uses to be retained, some are being suspended for failure to generate residue data in response to a data call-in request. These uses are: blackberries, blueberries, celery (plant-bed), dewberries, eggplant (plant-bed), green onions, lettuce, mangoes, peppers (plant-bed), pimientos (plant-bed), raspberries, spinach (plant-bed), and taro. Since the benefits have been determined to outweigh the risks for these uses of captan, registration can be supported with the submission of required data. This final decision encourages persons interested in having these uses available to pursue registration with the captan registrants and/or work with IR-4 to get the uses reinstated.

As part of its assessment and review of the residue data submitted by registrants, OPP considered whether changes were needed in existing tolerances. OPP now believes that some tolerances need to be reduced and tolerances supporting uses which are being cancelled need to be revoked. We plan to initiate these actions during 1989.

Risk estimates for mixer/loader/applicators of captan for food and non-food uses range remain as calculated in the PD 2/3. The only difference is that the range is now from $10^{-5}$ to negligible since the one use with a $10^{-5}$ to $10^{-4}$ risk, use in pet shampoos, is being voluntarily cancelled by the registrant. The risk reduction measures contained in the PD 2/3 were specified in the Registration Standard when it was issued in 1986, and major registrants have amended their labels to comply with them. It is acknowledged in the PD 4 that the risks without protective clothing are acceptable and therefore are not including the protective clothing requirements in the PD 4. However, compliance with these measures is in accordance with good practice and they should be adhered to.

5. Contact person at EPA

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